MONTHLY WEATHER REVIEW.

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INTRODUCTION.

This REVIEW contains a general summary of the meteorological conditions which prevailed over the United States and Canada during May, 1885, based upon the reports from the regular and voluntary observers of the Signal Service and from co-operating state weather services.

Descriptions of the storms which occurred over the north Atlantic ocean during the month are also given, and their approximate paths shown on chart i.

Phenomenally large masses of ice, both field and bergs, have been observed in the Atlantic during the month. On referring to the chart it will be seen that the area of the ice-region is much greater than is usual for the month of May.

The number of atmospheric depressions traced on chart i. and described under "Areas of low barometer" is seven, or two less than the average number for May during the last eleven years.

The severest local storms and tornadoes of the month were those which occurred during the prevalence of low areas v. and vi., on the 15–16th, and 24–25th, respectively.

Destructive freshets occurred in Kansas, Nebraska, and Texas, causing great damage to the growing crops and loss of stock.

As in April, the mean temperature exhibits no marked departures from the normal. The month was slightly warmer than the average in the Pacific coast districts, and slightly colder than the average in all districts east of the Rocky mountains, except in the upper Ohio valley, northern New England, and along the Atlantic coast from Virginia to Florida, where the mean temperature was normal or slightly above.

The most important features in connection with the monthly precipitation were the marked excess over the average in the south Atlantic states and the Rio Grande valley, and the large deficiency in the northern slope, extreme northwest, upper lake region, and throughout the Mississippi valley.

Temperature and rainfall observations in the cotton region were resumed May 1st. In this REVIEW will be found a table showing the means for the several districts, with the May averages for the three preceding years.

In the preparation of this REVIEW the following data, received up to June 20th, 1885, have been used, viz.: the regular tri-daily weather-charts, containing data of simultaneous observations taken at one hundred and twenty-nine Signal Service stations and sixteen Canadian stations, as telegraphed to this office; one hundred and sixty-eight monthly journals and one hundred and sixty-five monthly means from the former, and sixteen monthly means from the latter; two hundred and eighty-eight monthly registers from voluntary observers; forty-five monthly registers from United States Army post surgeons; marine records; international simultaneous observations; marine reports through the co-operation of the "New York Herald Weather Service;" abstracts of ships' logs, furnished by the publishers of "The New York Maritime Register;" monthly reports from the New England Meteorological Society, and from the local weather services of Alabama, Georgia, Indiana, Iowa, Louisiana, Nebraska, Ohio, and Tennessee, and of the Central Pacific Railway Company; trustworthy newspaper extracts, and special reports.

ATMOSPHERIC PRESSURE.

[*Expressed in inches and hundredths.*]

The distribution of mean atmospheric pressure for May, 1885, determined from the tri-daily telegraphic observations of the Signal Service, is shown by the isobarometric lines on chart ii.

The mean pressure is 29.95, or above, along the middle Pacific coast, in Oregon and Washington Territory, over a small area including portions of Georgia and South Carolina, in Nova Scotia, New England, and portions of the lower lake region and middle Atlantic states. But four stations report monthly barometric means of 30.0 or above, viz: Fort Canby, Washington Territory, and Roseburg, Oregon, 30.0; Halifax, Nova Scotia, 30.01, and Yarmouth, Nova Scotia, 30.02. An area of barometric minima is shown in southern Arizona, where the monthly barometric means are below 29.75, the lowest being 29.73 and 29.74, respectively, at Forts Grant and Thomas. In the central and southern Rocky mountain districts, Rio Grande valley, and over portions of the upper lake region and upper Missouri valley the mean pressure is 29.9, or below.

As compared with the mean pressure for the preceding month, an increase of .01 to .07 occurs in northern New England and the Maritime Provinces. In all other parts of the country the barometric means are lower than for April. The deficiency exceeds .10 in the southern plateau, upper Missouri valley, and over an area extending from the lake region to the south Atlantic and east Gulf coasts. In the remaining districts the deficiencies vary from .01 to .10.

The departures from the normal pressure are given in the table of miscellaneous meteorological data; they are also shown on chart iv. by lines connecting stations of equal departure. The pressure is above the normal over the central and southern Rocky mountain districts, and from southeastern Montana to the lower Missouri valley; along the New England coast it is normal, and in all other portions of the country it is below the normal. The departures above the normal nowhere exceed .05, and, except at Santa Fé, New Mexico, they vary from .01 to .03. The departures below the normal are .05 or less, except in the north and middle Pacific coast regions and over an area extending from the upper lakes southeastward to the Atlantic and east Gulf coasts.

The monthly barometric ranges at the various stations of the Signal Service are given in the table of miscellaneous data. In the southern portions of California and Arizona the ranges vary from .24 to .29; on the north Pacific coast, in the central Rocky mountain districts, and along the Gulf coast, they vary from .30 to .50; they exceed .70 in the Ohio valley and in the northern districts from Dakota eastward to the

Atlantic coast. The following stations report the largest monthly ranges: Eastport, Maine, 1.14; Marquette, Michigan, .98; Mount Washington, New Hampshire, .94.

AREAS OF HIGH BAROMETER.

Seven areas of high barometer passed over the United States during the month of May. Four of these were first observed in the British Northwest Territories; two approached from the north Pacific coast; and one was apparently a secondary high area which formed within the limits of stations east of the Mississippi, and passed eastward with increasing pressure, until it disappeared east of Nova Scotia. The following is a general description of these high areas, and the direction of movement and the most important changes observed during their transit over the United States:

I.—This high area was advancing from the region north of Dakota on the morning of the 1st, attended by freezing weather along the line of the northern boundary of the United States from Lake Superior to Montana. It extended over the northwest and upper lake region during the 1st and 2d attended by cold, fair weather, the general direction being almost to the south during the 2d and 3d, while the storm immediately to the eastward was moving northward. As this area approached the south Atlantic coast, it became less clearly defined and finally disappeared without causing any marked changes in temperature in southern or eastern districts.

II.—This area, although first marked central north of Montana, probably advanced from the north Pacific coast. It remained central in the region north of Montana and Dakota from the 7th to 10th, the retardation in that region being due to the development of a severe storm in the lake region, which remained almost stationary during the 7th, 8th, and 9th. While this storm was central in the lake region, the high area extended southward over the eastern Rocky mountain slope districts as far as the valley of the Rio Grande, causing dangerous northerly winds on the west Gulf coast on the 8th. The barometer continued highest north of Montana, but the direction of the wind at stations south of the Missouri valley shows that a secondary high area formed over Kansas and Indian Territory on the afternoon of the 8th. Very heavy rains, followed by generally clear weather and northerly winds, occurred along the west Gulf coast immediately after the formation of this secondary high area. These conditions prevailed over the districts of the central valleys on the 11th, when this high area had disappeared from the northwest and was faintly defined in Tennessee. Previous to this date the movement was southeasterly, attended by decreasing pressure near the centre, and after this date the direction of movement was to the north of east, attended by increasing pressure as it passed over the north Atlantic coast line and Nova Scotia. It disappeared on the 14th.

III.—A high area with slight intensity was developed over the lower lake region on the 14th. It remained nearly stationary and extended over the regions east of the Mississippi on the 15th, attended by fair weather, and then moved eastward on the 16th and 17th, the pressure increasing as it passed over the north Atlantic.

IV.—This was the most northerly area observed during the month, and its centre was at no time within the limits of the United States. The morning report of the 17th shows the advance of this area far to the north of Manitoba; it moved to the southeastward on the 18th, 19th and 20th, causing cool north to east winds in the lake region. It was central in the lower Saint Lawrence valley on the 21st, and afterwards it passed over New England and the Maritime Provinces. The pressure increased as it approached the Atlantic coast and reached its maximum on the morning of the 22d, when the centre was near and to the south of Halifax.

V.—This area appeared on the north Pacific coast at midnight of the 21st, and the centre of greatest pressure remained west of the coast line until the morning of the 23d, although the morning report of that date showed a general increase of pressure from the Rocky mountains westward to the Pacific coast. It moved southeastward during the 24th and 25th, becoming less clearly defined, and disappearing as a high area before reaching the Mississippi valley. It was preceded by general rains on the north Pacific coast and heavy local rains on the middle and southern slopes of the Rocky mountains.

VI.—The morning report of the 26th gave the first indications of the approach of this area from the regions north of of Manitoba. It moved southeastward over a course similar to that described as number iv., passing north of the lake region on the 27th and crossing the Saint Lawrence valley and New England on the 28th, causing generally cool and fair weather in these districts. It was central off the New England coast on the morning of the 29th, and during that day it disappeared rapidly in advance of a low area then moving from the lake region.

VII.—This area appeared on the north Pacific coast on the 26th, but did not develop sufficient energy to pass eastward of the Rocky mountain stations. It apparently moved eastward over Washington Territory and western Montana on the 27th and 28th and extended over the Rocky mountain districts on the 29th; the barometer, however, remained highest on the north Pacific coast, where it continued high until the close of the month.

AREAS OF LOW BAROMETER.

Seven areas of low barometer have been traced over or near the United States during the month of May. These storms generally developed in the Rocky mountain region, and, while five of them apparently had their origin on the Pacific coast or in the plateau region, they were not sufficiently well-defined to render it possible to trace them west of the 105th meridian. The movement of these low areas west of the Mississippi was irregular, and, in many cases, it was difficult to locate the centre of disturbance. Numerous secondary depressions were formed which disappeared quickly and their movements are therefore not traced upon the chart. It will be seen from chart number i. that the low areas traced during the month moved generally to the northeast after passing the Mississippi valley, and that the direction of movement, when to the westward of that valley, was irregular, but inclined to the southeast.

The following table gives the latitude and longitude in which each area was first and last observed, and the average hourly velocity:

Areas of low barometer.	First observed.		Last observed.		Average velocity in miles per hour.
	Lat. N.	Long. W.	Lat. N.	Long W.	
	° ′	° ′	° ′	° ′	
No. I	40 00	104 00	51 00	63 00	31.0
II	52 00	99 00	{ 52 00 / 41 00	{ 99 00 / 67 00	14.0
III	37 00	76 00	41 00	67 00	15.0
IV	43 00	102 00	51 00	89 00	33.0
V	43 00	94 00	46 00	67 00	31.0
VI	52 00	104 00	53 00	63 00	26.0
VII	43 00	99 00	48 00	73 00	21.0
Mean hourly velocity					24.4

I.—This storm, as described in the last REVIEW, had originated in Colorado and passed directly eastward to the upper Ohio valley, where it was central on the morning of the 1st as a well-defined cyclone of slight energy. It moved directly eastward over the middle Atlantic states, causing severe gales on the middle Atlantic coast on the 1st, and when the centre was near the coast the course changed to northerly. During the 2d it passed along the New England coast with increasing energy, the barometer falling to 29.19 at Eastport, Maine, near the centre, on afternoon of the 2d. The northerly course continued until its centre passed to the north of Anticosti, and then apparently changed to the northeast. This storm was most severe while the centre was passing along the middle Atlantic and New England coasts; it developed slight energy while passing over the continent and was apparently filling up when last observed on the morning of the 3d.

II.—This low area moved southward from the region north of Manitoba on the 4th; it was central in Minnesota on the afternoon of that date, and by midnight it had extended over the upper lake region and Mississippi and Missouri valleys as an elliptical area, the longer axis being nearly east and west. Light rains prevailed in the districts north of the Ohio valley and in the northwest on the morning of the 5th, when the centre of disturbance was over Lake Michigan. The elliptical form continued but the longer axis was turning toward the northeast. The afternoon report of the 5th showed that this area had divided, one area being central north of Lake Huron and one in Indian Territory, and the midnight chart exhibited three low areas, one in Arkansas, one in Illinois and one over Lake Huron, attended by rain from the Gulf coast northward to the lake region. The succeeding report of the 6th indicated that these secondary areas had united in the central Ohio valley and again separated, the principal area moving to the north of the lake region, and the secondary disturbance passing to the south Atlantic coast and thence northeasterly. The principal area, when central over Lake Superior, increased greatly in energy, owing to the advance of high area number ii., and severe gales occurred on the upper and lower lakes, attended by general rains or snow at the northern stations. During the 8th and 9th, after passing northward from the Ohio valley, this storm apparently moved slightly to the westward before taking up the usual northeasterly course. It increased in area and lost energy after leaving the lake region and disappeared to the northeastward on the 10th.

III.—This storm was at no time within the limits of the stations of observation, but its movement along the Atlantic coast from the 12th to the 15th can be approximately traced from barometric changes observed, and the direction and velocity of wind at the coast stations. Very heavy rains occurred on the North Carolina coast on the night of the 12th, and severe northerly gales were reported from this coast on the 13th. These gales extended over the middle Atlantic and southern New England coasts on the 14th, the wind reaching a velocity of fifty miles northeast at Block Island, Rhode Island, and forty-four miles at Boston, Massachusetts, between afternoon and midnight of the 14th. The succeeding reports of the 15th indicate that this storm did not pass over the Atlantic, but that it disappeared by gradual rise in the barometer, when the centre was near Nova Scotia.

IV.—This low area resulted from an extended depression covering the mountain districts during the 12th, 13th, and 14th. There was a gradual movement of this extended low area to the eastward and by the afternoon of the 15th the trough of low pressure extended from Texas northward to the British possessions. Two areas of depression were well defined on the midnight weather chart of the 15th, one central in northeastern Dakota and the other central in Kansas. This storm was accompanied by very heavy rains in the central Missouri valley and eastern Dakota on the 15th. It moved directly northeast and passed north of the lake region, disappearing during the 16th, attended by strong south to west winds in the upper lake region.

V.—This storm probably originated in the southwest and although its centre cannot be located at each consecutive tri-daily report, it is probably a development of a secondary area referred to in number iv. It is first marked as central in Iowa on the morning of the 17th. The barometer was low in all districts from the lower Mississippi valley westward to the Pacific coast and it was lowest in Arizona, but the winds in the northwest indicated the development of this storm which passed eastward from Iowa over the lake region, attended by light rain in the northern states and light to fresh winds in the lake region. This depression increased in size as it approached the coast, the barometer remaining about stationary and the winds becoming light and variable. It disappeared in the northeast with indications of decreasing energy.

VI.—This disturbance was first marked as central north of Dakota on the afternoon of the 22d; it had previously extended over the mountain districts to the westward, and it probably originated on the Pacific coast. It remained north of Minnesota until the afternoon of the 23d, when it moved southward to southern Minnesota, the depression being in form of a barometric trough extending southward to Texas, inclosed between high areas which covered the Atlantic coast and the Rocky mountain districts. The morning report of the 24th shows three minor depressions within this barometric trough, one central in Indian Territory, one in southern Minnesota, and the third northeast of Manitoba. These minor depressions disappeared during the 24th, apparently uniting with the central disturbance and passing over the upper lake region to the northeast, accompanied by fresh and brisk winds in the lake region, and general rains in the northern and local rains in the southern states. This storm continued its course northeastward north of the Saint Lawrence valley during the 25th and 26th with decreasing pressure at the centre, but without causing severe gales, owing to the slight gradient which was due to the extension of the low area.

VII.—Previous to the development of this disturbance in the central Missouri valley on the afternoon of the 28th, the barometer had been low in the region south of Nebraska and Wyoming, and the reports indicate that a depression with slight energy moved from Colorado eastward to the Missouri valley during the 27th; when the centre was located near Yankton, Dakota, on the afternoon of the 28th, the depression extended southeastward to the lower Ohio valley and a secondary distubance, which had disappeared at the succeeding report, appeared to be central in Missouri. The storm moved southeastward over the Mississippi valley, causing general rains in all districts and strong north to east winds on the west Gulf coast. It was elliptical in form and enclosed by the isobars for 29.7, 29.8, and 29.9, on the morning of the 29th, when central near Keokuk, Iowa. This general form continued during the two succeeding reports, when the storm-centre reached its most southerly point, near Champaign, Illinois, after which it moved rapidly northeastward to the Saint Lawrence valley, where it was central at the close of the month as a depression of slight energy.

NORTH ATLANTIC STORMS DURING MAY, 1885.

[*Pressure expressed in inches and in millimetres; wind-force by scale of 0-10.*]

The paths of the depressions that have appeared over the north Atlantic ocean during the month are determined, approximately, from international simultaneous observations furnished by captains of ocean steamships and sailing vessels; abstracts of ship's logs and other data collected by the Signal Service agencies at the ports of New York, Boston, and Philadelphia; reports furnished through the co-operation of the "New York Herald Weather Service," and from other miscellaneous data received at this office up to June 21st, 1885.

Of the ten depressions shown on the chart, that traced as number 8 appears to have been a continuation of a storm which entered the Atlantic from the North American continent; number 5 appeared off the South Carolina coast on the 10th, and dispersed on the following day when south of Nova Scotia; numbers 3 and 4 developed over the Banks of Newfoundland and occupied mid-ocean during the first decade of the month, finally disappearing in the neighborhood of the Azores; number 10 appeared near N. 50°, W. 40°, on the 28th, and may have been a continuation of a disturbance which left the Labrador coast on the 26th, its centre, on the 27th, being far beyond the limits of the marine observations. Numbers 2 and 9 appeared between N. 45° and 50° and W. 30° and 35°; the former moving eastward to the Bay of Biscay and the latter northeastward beyond N. 55°, W. 20°. The remaining depressions, numbers 1, 6, and 7, appeared between W. 20° and the British coasts, having apparently approached from the northwestward.

The general direction of movement of the storm-centres during May, 1885, was east-northeasterly, excepting those which appeared first near the British coasts; these moved southeastward. During the first and last decades of the month the at-